

**A New Approach to Hearing Conservation
The LIDEN Approach
for Noise Exposure Management in the Workplace**

Current State of Play

The widespread approach to dealing with a noisy workplace is to give workers hearing protection and then to conduct pure tone audiometry at regular intervals. This approach has been commonplace in industry for many decades; since we have long understood that workplace noise causes noise induced hearing loss (NIHL) and other hearing effects. However, although our understanding of the effects of noise are well recognised, there has been little real impact on the number of workers making claims against companies for NIHL. This suggests that the current approach to dealing with this occupational hazard is not effective and continues to negatively impact on the health of workers.

The current approach can be compared to placing a ‘sticking plaster’ over a problem and then monitoring the effects getting progressively worse. The regulatory approach to all health and safety hazards sets out a preventative hierarchy of control, where the risk should be eliminated where possible or controlled at source to ensure a safe working environment. Maybe due to the fact that we have understood noise risks for so long, there seems to be a complacent attitude and an acceptance that harm may be inevitable when it comes to dealing with noise exposure.

Why is this a problem?

The problem currently is that noise is thought to be too difficult to control in a proactive way and that protecting workers can only be achieved by relying on hearing protection devices. As a form of personal protective equipment, hearing protectors are a last line of defence in the hierarchy of control. They should only be used for short-term protection and wholly rely on the user being compliant, competent and consistent in using them effectively. Because of this, they are prone to failure.

Health surveillance within a health risk management system should inform and reassure an effective programme of noise control. It is intended to provide early signs of health effects that can be related to exposure, so that the effectiveness of controls can be confirmed and any vulnerable workers can be identified and managed accordingly. Pure tone audiometry detects hearing damage at a level where damage is significant enough to affect the ability to hear pure tones. The test is subjective and requires the cooperation from the individual being tested to respond to the pure tone signals being presented. There is often a long time between hazardous exposure and hearing loss being detected, causing difficulties in the method being able to provide a timely preventative approach to re-visiting risk assessment, controls and taking action.

“Despite redrafting, re-emphasis and a new scheme for categorisation with validated reference thresholds, questions are still being raised as to the usefulness of audiometry in allowing preventative action against hearing damage caused by noise at work”

International Expert Symposium on the usefulness of Otoacoustic Emissions Testing in Occupational Health Surveillance
February 2011, Manchester, UK.

A New Approach

Why is noise different to any other hazard? What can motivate us to take a preventative and intervening approach to dealing with noise risks? We need a hearing conservation approach which starts with looking at options to eliminate or reduce noise at source. Once we have done this we need information that gives us an early or 'leading' indication of damaging exposure to noise i.e. a risk to health. The LIDEN approach (Leading Indication of Damaging Exposure to Noise) would give those responsible for protecting noise exposed workers timely information to take action to intervene where problems are identified. The LIDEN approach has been developed following extensive research in this area by HSE over a number of years. It has involved collaboration with leading experts across the world.

OAEs are sounds (echos) created by the hair cells in the cochlea when stimulated by sound. These hair cells are the first part of the auditory pathway to be affected by exposure to noise. The measurement of OAEs is simple and quick, and the results provided are objective and can be monitored over time. Changes in OAEs can indicate an effect on the function of the hair cells caused by unprotected exposures. In a noisy workplace this information can be useful as a leading indicator that something may be wrong with noise control in certain tasks, with certain workers or certain parts of the workplace. These indications can be investigated to check risk assessments and controls remain effective, taking proactive action when required

Implementing a hierarchical approach to controlling noise at source and then checking on controls and risk management processes using the LIDEN approach would move our current strategies on dealing with noise exposure to a more informed, proactive and intervening approach. This has a huge potential to making a real difference in protecting our workers from irreversible NIHL due to noise assaults.

As the LIDEN approach provides indications of damage which will prompt further investigation, it should sit alongside a longer term formal health surveillance programme incorporating Pure Tone Audiometry as the system for categorising hearing, with onward referral for diagnosis when appropriate. This system is currently outlined in HSE guidance (Control of Noise at Work Regulations L108).

Recommended Procedure for Undertaking a LIDEN Approach for Hearing Conservation

LIDEN Three Stage Approach

- Baseline = Pre-test procedures, Otoacoustic Emission (OAE) testing, Pure Tone Audiometry (PTA).
- Annual test = Pre-test procedures & OAE test only. Unless requirement for PTA indicated by other information i.e. new or vulnerable workers.
- Triannual test = Pre-test procedures, OAE & PTA testing.

Pre Test Procedures

Noise & Health Questionnaire (as provided in HSE guidance to Control of Noise at Work Regulations L108, Appendix 6).

Otososcopic Examination:

Reason for activity	Tester requirements	Equipment requirements	Test parameters	Result interpretation	Outcome activity
Identify excessive or obstructive cerumen.	Right and left ear sequentially.	Otoscope. Record result in medical records.	View tympanic membrane.	If obstructed with cerumen arrange for removal.	Proceed to impedance test.

Impedance Test (Tympanometry):

Reason for activity	Tester requirements	Equipment requirements	Test parameters	Result interpretation	Outcome activity
Measure middle ear pressure and flaccidity of tympanic membrane.	Right and left ear sequentially.	Automated tympanometer. Ear nubs of correct size to cause a sealed external ear. Using a 226 Hz probe tone.	Tympanic membrane mobility. Middle ear Impedance.	Type A tympanograms. Peak values comprised from 0.5 to 1.6 ml at ± 50 daPa.	Proceed to acoustic reflex.

Acoustic Reflex:

Reason for activity	Tester requirements	Equipment requirements	Test parameters	Result interpretation	Outcome activity
Confirm clear middle ear pathway.	Right and left ear sequentially.	Tympanometer with acoustic reflex test.	1kHz at 100dB.	Reflex present.	Proceed to DP OAE test.

Annual Test

Distortion Product Otoacoustic Emission (DPOAE) Test:

Reason for activity	Tester requirements	Equipment requirements	Test parameters
Cochlear function.	Right and left ear sequentially.	DPOAE Machine.	L1/L2 = 70/75 dB F2 frequencies = 1/8 frequencies per octave i.e. 814Hz,917Hz,1000Hz,1091Hz, 1189Hz,1297Hz,1542Hz,1682Hz, 1834Hz,2000Hz,2181Hz,2378Hz,2594Hz 2828Hz, 3084Hz,3364Hz,3668Hz,, 4000Hz,4362Hz,4757Hz, 5187Hz,5657Hz, 6169Hz, 6727Hz,7336Hz,8000Hz

Result interpretation	Outcome analysis
<p>SNR = 6dBSPL at a minimum of 2 frequencies.</p> <p>Establish baseline initially.</p> <p>If >3dBSPL reduction in DPOAE emission strength from previous test, replicate the test in the individual.</p> <p>This can be at a time period suitable for tester. It can be immediately based on consideration of possible confounding factors for test results i.e. TTS, ill health etc.).</p> <p>Following re-test; take the better set of results as the outcome of test.</p>	<p>If 3-5dBSPL reduction in emission from previous test at any frequency counsel client and warn of deterioration.</p> <p>Review other results on similar exposed workers. If similar or greater deterioration in one or more similarly exposed workers there is a need to review noise management procedures to ensure protection is being ensured (i.e. controls, PPE, supervision etc.).</p> <hr/> <p>If 5-10dBSPL reduction in emission from previous test at any frequency counsel client and warn of deterioration. Consider referral for PTA.</p> <p>Review other results on similar exposed workers. If similar or greater deterioration in one or more similarly exposed workers there is a need to review noise management procedures to ensure protection is being ensured (i.e. controls, PPE, supervision etc.).</p>

Triannual Test

Conduct as per annual test plus PTA. Conducting PTA is outlined in HSE guidance (Control of Noise at Work Regulations L108, Appendix 5).